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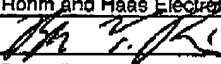
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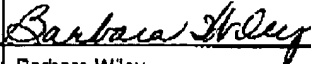
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TRANSMITTAL FORM		Application Number	10/785,666
		Filing Date	Feb 23, 2004
		First Named Inventor	Lavoie, Jr., Raymond Lee
		Art Unit	3723
		Examiner Name	B. R. Muller
Total Number of Pages In This Submission	15	Attorney Docket Number	03012US

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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT		
Firm Name	Rohm and Haas Electronic Materials CMP Holdings, Inc.	
Signature		
Printed name	Blake T. Biederman	
Date	December 11, 2006	Reg. No. 34,124

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**RECEIVED
CENTRAL FAX CENTER****DEC 11 2006****IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): Lavoie, Jr. et al.

Application No.: 10/785,666

Filed: 2/23/2004

Title: POLISHING COMPOSITIONS FOR
CONTROLLING METAL INTERCONNECT
REMOVAL RATE IN SEMICONDUCTOR WAFERS

Art Unit:

3723

Examiner:

B. R. Muller

Attorney Docket No.: 03012US

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

APPEAL BRIEF

Applicants respectfully appeal the rejection dated August 29, 2006.

(1) REAL PARTY IN INTEREST

The real party in interest in this appeal is Rohm and Haas Electronic Materials CMP Holdings, Inc.

(2) RELATED APPEALS AND INTERFERENCES

There is no related appeal or interference.

(3) STATUS OF CLAIMS

Claims 1 to 10 – Rejected.

(4) STATUS OF AMENDMENTS

Claims 2, 6 and 7 amended after the final Official Action—Advisory Action to enter amendments for purposes of appeal—claims 2, 6 and 7 below enter the amendments.

(5) SUMMARY OF THE CLAIMED SUBJECT MATTER

Claim 1 covers a polishing composition suitable for polishing semiconductor substrates having a non-ferrous interconnect (Para. 29, lines 1 and 2). The composition includes the following: 0.1 to 1.5 wt% of a polyvinyl alcohol (Para 13, lines 2 and 3; and Para. 12 lines 1 and 2); 0.01 to 0.85 wt% of polyvinylpyrrolidone (Para. 16, lines 2 and 3); up to 10 wt% of a corrosion inhibitor (Para. 25, line 3); up to 15 wt% complexing agent (Para. 27, lines 11 and 12); up to 10 wt% of an oxidizing agent (Para. 7); and 0.05 to 40 wt% of an abrasive (Para. 22, line 1) wherein the polishing composition has a pH of at least 7 (Para. 26, lines 2 and 3) and wherein increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the polishing removal rate of the non-ferrous interconnect (Para. 6 and Para 36, lines 1 to 4).

Claim 7 covers a polishing composition suitable for polishing semiconductor substrates having a non-ferrous interconnect (Para. 29, lines 1 and 2). The composition includes the following: 0.1 to 1.5 wt% of polyvinyl alcohol (Para 13, lines 2 and 3; and Para. 12 lines 1 and 2); having a weight average molecular weight of 3,000 to 500,000 g/mole (Para. 11, lines 3 and 4); 0.01 to 0.85 wt% of polyvinylpyrrolidone (Para. 16, lines 2 and 3) having a weight average molecular weight of 1,000 to 250,000 g/mole (Para. 14, lines 3 to 5); up to 10 wt% of a corrosion inhibitor (Para. 25, line 3); up to 15 wt% complexing agent (Para. 27, lines 11 and 12); up to 10 wt% of an oxidizing agent (Para. 7) ; and 0.1 to 40 wt% of a silica abrasive (Para. 22, lines 1 and 2 and Para. 20, line 7); wherein the polishing composition has a pH of at least 7 (Para. 26, lines 2 and 3), and further wherein increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the polishing removal rate of the non-ferrous interconnect (Para. 6 and Para 36, lines 1 to 4).

Claim 8 covers a method of polishing a semiconductor substrate having a non-ferrous interconnect (Para. 29, lines 1 and 2). The method includes applying a polishing composition

including the following: 0.1 to 1.5 wt% of a polyvinyl alcohol (Para 13, lines 2 and 3; and Para. 12 lines 1 and 2); 0.01 to 0.85 wt% of polyvinylpyrrolidone (Para. 16, lines 2 and 3); up to 10 wt% of a corrosion inhibitor (Para. 25, line 3); up to 15 wt% complexing agent (Para. 27, lines 11 and 12); up to 10 wt% of an oxidizing agent (Para. 7) ; and 0.1 to 40 wt% of an abrasive (Para. 22, lines 1 and 2) wherein the polishing composition has a pH of at least 7 (Para. 26, lines 2 and 3); and polishing the semiconductor substrate at a pad pressure less than or equal to 21.7 kiloPascals (Para. 30, lines 1 and 2), wherein increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the removal rate of the non-ferrous interconnect (Para. 6 and Para 36, lines 1 to 4).

(6) GROUNDS OF REJECTIONS TO BE REVIEWED ON APPEAL

1. Claims 1 to 10 stand rejected under 35 U.S.C. §103 (a) over Tsuchiya et al. (US Pat. Pub. No. 2002/0095872) in view of Kurata et al. (US Pat. Pub. No. 2003/0219982).

(7) ARGUMENT

I. Rejection of claims 1 to 10 for obviousness under 35 U.S.C. §103 (a) over Tsuchiya et al. in view of Kurata et al.

The combined references fail to establish a prima facie case of obviousness. In re Oetiker, 977 F. 2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). Tsuchiya et al. disclose a thickener in an amount of 0.001 to 0.05 wt% of a cationic surfactant, nonionic surfactant, anionic surfactant anionic, water-soluble polymer, nonionic water-soluble polymer or cationic water soluble particle. Tsuchiya et al. list about 20 cationic surfactants, 20 anionic surfactants, 10 total water-soluble polymers for a total of about 50 thickeners. The action selects polyvinylpyrrolidone from the list of nonionic water-soluble polymers. Specific Examples 1 to 7 from Tsuchiya et al., however, do not contain polyvinylpyrrolidone. Furthermore, Tsuchiya et al., fail to disclose the claimed benefits achieved with a combination of polyvinylpyrrolidone and polyvinyl alcohol. The action combines the polyvinylpyrrolidone of Tsuchiya et al. with the polyvinyl alcohol of Kurata et al.—Kurata et al. teach the use of polyvinyl alcohol in

combination with a film forming agent, but fail to disclose the claimed increasing polyvinyl alcohol to polyvinylpyrrolidone to decrease interconnect removal rate achieved with a combination of polyvinylpyrrolidone and polyvinyl alcohol. It is well established that a compound and its properties are inseparable. In re Papesch, 315 F.2d 381, 137 USPQ2d 43 (CCPA 1963). Part of evaluating the invention as a whole includes considering functional language. In re Caldwell, 319 F.2d 254, 138 USPQ 243 (CCPA 1963) recognizes the propriety of defining an invention by what it does.

First, obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. In re Geiger, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987). Because polyvinyl alcohol is a water-soluble polymer, it has a significant impact on the viscosity of the slurry. There would be no motivation for one skilled in the art to substitute an inhibitor with an inhibitor mixture that impacts the slurry's viscosity; since this could destroy the polyvinylpyrrolidone's thickener function of Tsuchiya et al. and would require at best a readjustment of the thickener concentration to compensate for the additional water-soluble polymer.

Second, the action applies an inappropriate "obvious to try" standard that represents an insufficient basis to form a prima facie case of obviousness by combining references. In moving from the prior art to the claimed invention, one cannot base a determination of obviousness on what the skilled person might try or find obvious to try. Both the suggestion and the expectation of success must be found in the prior art. In re Dow Chemical Co., 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1987). The action first selects a thickener from a list of about 50 thickeners (surfactants and water-soluble polymers), then a film forming agent from a second reference with a list of greater than 100 film forming agents and finally a water-soluble polymer from a list of over 30 water-soluble polymers from the Kurata et al. reference. In summary, the rejection combines a 1 in 50 thickener choice, with a 1 in 100 film forming agent choice and a 1 in 30 water-soluble polymer choice for a total of 1 combination from a total of 150,000 combinations to form the rejection. From these remote odds, the action selects benzotriazole with polyvinyl alcohol of Kurata et al. (selected from the thousands of CMP slurry patents) to substitute for the benzotriazole of Tsuchiya et al. in combination with polyvinylpyrrolidone.

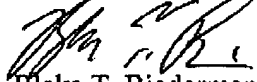
Applicants respectfully submit that this represents an impermissible obvious to try standard and that there is no expectation of success for the proposed combination. Furthermore, a disclosure of millions of possible choices does not render obvious a claim to a particular choice, especially when the disclosure indicates a preference leading away from the claimed invention In re Baird, 16 F.3d 380, 29 USPQ 2d 1550, (Fed. Cir. 1994).

Third, the combined references teach away from the claimed invention. It is well accepted that proceeding contrary to conventional wisdom represents strong evidence of unobviousness. In re Hedges, 783 F.2d 1038, 228 USPQ 685, 687 (Fed. Cir. 1986). Table 1 of Kurata et al. teaches that polyvinyl alcohol increases copper removal rate (Example 4 with polyvinyl alcohol removes copper at 135 nm/min and Comparative Example 1 with no polyvinyl alcohol removes copper at 80 nm/min.)—see earlier-submitted Declaration of Dr. Terrence Thomas. In addition Kurata et al. at paragraph 53, lines 23 to 29 state “In the polishing liquid for metal of the present invention, it is assumed that, as the protective film forming agent is used in combination with the water-soluble polymer, the protective film forming agent w[i]ll suppresses etching but fails to function as a metal surface protective film with respect to the friction caused by the polishing pad, thereby allowing a sufficiently high CMP rate.” Applicants have discovered that PVA in combination with polyvinylpyrrolidone decreases polishing rate of non-ferrous metals. Applicants’ amended claims reflect that increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the removal rate of the non-ferrous interconnect. Thus, since Kurata et al. disclose use of water-soluble polymer to maintain a high copper removal rate and the Example from Table 1 illustrates that PVA increases copper removal rate, Applicants respectfully submit that the combined references teach away from the claimed invention.

Thus, since the references fail to disclose the benefits achieved with a combination of polyvinylpyrrolidone and polyvinyl alcohol, there is no motivation to add an inhibitor that would function as a thickener to a thickener-containing slurry because of potential adverse viscosity consequences, the action relies on selecting a particular combination of ingredients from a list of 150,000 possibilities with no expectation of success and Kurata et al. teach away from using

polyvinyl alcohol to reduce interconnect removal rate, Applicants respectfully submit that claims 1 to 10, as amended, are not obvious in view of the combined references.

Respectfully submitted,



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Newark, DE 19713

CLAIMS APPENDIX

1. A polishing composition suitable for polishing semiconductor substrates having a non-ferrous interconnect comprising:

0.1 to 1.5 wt% of a polyvinyl alcohol; 0.01 to 0.85 wt% of polyvinylpyrrolidone;

up to 10 wt% of a corrosion inhibitor;

up to 15 wt% complexing agent;

up to 10 wt% of an oxidizing agent; and

0.05 to 40 wt% of an abrasive wherein the polishing composition has a pH of at least 7 and wherein increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the polishing removal rate of the non-ferrous interconnect.

2. The composition of Claim 1, wherein the polyvinylpyrrolidone has a weight average molecular weight of 1,000 to 250,000 g/mole.

3. The composition of Claim 1, wherein the abrasive particles include silica particles.

4. The composition of Claim 1, wherein the polyvinyl alcohol has a weight average molecular weight of 1,000 to 1,000,000 grams per mole and a degree of hydrolyzation of at least 20 mole percent, wherein the mole percent is based upon the total number of moles of the polyvinylalcohol.

5. The composition of Claim 1, wherein the polyvinylpyrrolidone has a weight average molecular weight of 100 to 1,000,000 grams per mole.

6. The composition of Claim 1, wherein the polyvinylpyrrolidone and the polyvinyl alcohol polymer is present in the polishing composition in a weight ratio of 1:10 to 100:1 respectively.

7. A polishing composition suitable for polishing semiconductor substrates having a non-ferrous interconnect comprising:

0.1 to 1.5 wt% of polyvinyl alcohol having a weight average molecular weight of 3,000 to 500,000 g/mole;

0.01 to 0.85 wt% of polyvinylpyrrolidone having a weight average molecular weight of 1,000 to 250,000 g/mole;

up to 10 wt% of a corrosion inhibitor;

up to 15 wt% complexing agent;

up to 10 wt% of an oxidizing agent; and

0.1 to 40 wt% of a silica abrasive; wherein the polishing composition has a pH of at least 7, and further wherein increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the polishing removal rate of the non-ferrous interconnect.

8. A method of polishing a semiconductor substrate having a non-ferrous interconnect comprising the steps of:

applying a polishing composition comprising 0.1 to 1.5 wt% of a polyvinyl alcohol; 0.01 to 0.85 wt% of polyvinylpyrrolidone; up to 10 wt% of a corrosion inhibitor;

up to 15 wt% complexing agent; up to 10 wt% of an oxidizing agent; and 0.1 to 40 wt% of an abrasive wherein the polishing composition has a pH of at least 7; and

polishing the semiconductor substrate at a pad pressure less than or equal to 21.7 kiloPascals, wherein increasing the weight ratio of the polyvinyl alcohol to the polyvinylpyrrolidone decreases the removal rate of the non-ferrous interconnect.

9. The method of Claim 8, wherein the polishing composition facilitates a removal rate of less than or equal to 150 Angstroms/minute for the low-k dielectric layer.

10. The method of Claim 8, wherein the polishing composition facilitates a removal rate of greater than or equal to 150 Angstroms/minute for the low-k dielectric layer.

EVIDENCE APPENDIX

Attached please find the 1.132 Declaration of Dr. Terrence Thomas.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Lavoie, Jr. et al.	
Application No.: 10/785,666	Art Unit: 3723
Filed: 2/23/2004	Examiner: B. R. Muller
Title: POLISHING COMPOSITIONS FOR CONTROLLING METAL INTERCONNECT REMOVAL RATE IN SEMICONDUCTOR WAFERS	
Attorney Docket No.: 03012US	
Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	

DECLARATION UNDER 37 C.F.R. § 1.132

That I Terence Michael Thomas declare the following:

1) That I am a current employee of Rohm and Haas Electronic Materials CMP Inc. (fka Rodel, Inc.); and that I have been employed at RHEM CMPT for over seven years in the role of developing polishing formulations and currently have the title of Senior Research Chemist.

2) That my professional qualifications include the following:

Ph.D. Inorganic Chemistry - University of Tennessee, Knoxville, Tennessee
M.S. Physical Chemistry - Colorado State University, Fort Collins, Colorado
B.A. Major: Chemistry Minor: Physics - Benedictine College, Atchison, Kansas

3) That I have published several articles, including the following:

Integrated CMP Barrier Slurry Development to Achieve Adjustable Rate Selectivities,
Qianqiu (Christine) Ye, John Quanci, Mathew VanHanchem, Terence Thomas, Conference
Proceedings CMP MIC, February 2002.

Cleaning Chemistries for Post CMP Processing for Both Hydrophobic Low Dielectric Constant and TEOS SiO₂ Materials, K. H. Block, T. Thomas, J. So and R. Schmidt, Conference Proceedings IITC, June 2002.

CMP Surface Characteristics of Twinned Copper Subgrains, C.Y. Ni, I.W. Hall, T. M. Thomas, J. K. So, J. Quanci, J. Phys. D: Appl. Phys. 37 (2004) 2446.

4) That I have reviewed Kurata et al. US Pat. Pub. No. 2003/0219982 and Tsuchiya et al. US Pat. Pub. No. 2002/0095872 and US Ser. No. 10/785,666.

5) That Table 1 of Kurata et al. suggests that polyvinyl alcohol decreases copper etch rate. Static etch represents a post-polishing issue that can have a detrimental impact upon the semiconductor; and copper static etch is not an absolute predictor of copper polishing rate.

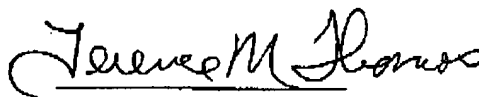
6) That Kurata et al.'s Table 1 discloses a copper removal rate of 80 Å/minute without polyvinyl alcohol and a copper polish removal rate of 130 Å /minute with polyvinyl alcohol, a 50 Å /minute increase in copper removal rate during polishing.

7) That it is my opinion that Table 1 of Kurata et al. suggests that polyvinyl alcohol increases copper removal rate and that it does not suggest that polyvinyl alcohol decreases copper removal rate during polishing.

8) That Tsuchiya et al. disclose polyvinyl alcohol as a thickener for increasing the viscosity of a slurry. Furthermore, from my experience, there is typically no expectation for a thickener to have a significant impact upon polishing removal rate. Specifically, changes in a liquid phase's viscosity do not result in foreseeable changes in polish removal rate of a solid phase.

9) In my opinion as scientist skilled in the art of slurry development, there is no motivation in Kurata et al. to combine PVP with the PVA of Tsuchiya et al. to lower copper removal rate.

9) That I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



Dr. Terence M. Thomas

April 25, 2006

RELATED PROCEEDINGS APPENDIX

None.